

MONTHLY WEATHER REVIEW,

AUGUST, 1878.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In compiling the present REVIEW the following data, received up to September 14th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 118 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means, 122 and 139 respectively, from the former, and monthly means from 13 of the latter; reports from 22 special Sunset stations; 240 monthly registers from Voluntary Observers; 48 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports of the Weather Services of the States of Iowa and Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown the general distribution of the atmospheric pressure for the month by the isobaric lines. Compared with the means for August of previous years, the pressure of the present month is decidedly lower in all sections, except in the extreme Northwest and at the Rocky Mountain and Pacific coast stations, where it is slightly above the normal.

The Local Barometric Ranges, as reduced to sea-level, for the month, vary as follows: New England, from 0.66 of an inch at Newport and New London to 0.76 at Eastport and 0.77 at Mt. Washington; Middle Atlantic States, 0.43 at Lynchburg to 0.68 at Albany; South Atlantic States, 0.30 at Jacksonville to 0.47 at Cape Hatteras; Gulf States, 0.25 at New Orleans to 0.28 at Key West, 0.31 at Mobile and Corsicana, and 0.21 at Galveston; Ohio valley and Tennessee, 0.30 at Louisville to 0.50 at Pittsburg; Lower Lake region, 0.39 at Sandusky to 0.61 at Oswego; Upper Lake region, 0.34 at Chicago to 0.61 at Alpena; Upper Mississippi valley, 0.28 at St. Louis to 0.57 at St. Paul; Red River of the North valley, 0.60 at Pembina to 0.67 at Breckenridge; Missouri valley, 0.52 at Bismarck to 0.57 at Yankton; Plains of Nebraska and Kansas, 0.64 at Dodge City to 0.72 at North Platte; Rocky Mountains, 0.25 at Pike's Peak to 0.44 at Denver; Utah, 0.38 at Salt Lake City; Idaho Territory, 0.55 at Boise City; Montana Territory, 0.39 at Virginia City; Nevada, 0.31 at Pioche to 0.45 at Winnemucca; California, 0.37 at San Diego to 0.53 at Red Bluff; Oregon, 0.53 at Portland to 0.54 at Roseburg.

Areas of High Barometer.—Six have been sufficiently well marked to justify a brief description: two of them, Nos. II and IV, moved southward along the Atlantic sea-board, while the other four were mostly confined to the Northwest and eastern slope of the Rocky Mountains. The heavy rains or "cloud bursts" in the mountains of Colorado and New Mexico occurred while high pressures were to the north of this section as follows: The heavy rains of the 10th in New Mexico on the approach of area No. I; of the evenings of the 23d and 24th in Colorado and New Mexico on the approach of No. V, and of the 27th in southern Colorado on the approach of No. VI.

No. I.—This area appeared on the Pacific coast on the morning of the 8th, and probably took the course indicated by the following barometric readings: 8th, a. m. barometers at Olympia, W. T., and Portland, Or., respectively, 30.11 and 30.18, or 0.14 and 0.11 in. above normal. 9th, a. m. barometers at Olympia and Virginia City, Mont. T., 30.13 and 29.91 or 0.16 and 0.10 in. above normals. 10th, a. m. barometers at Virginia City and North Platte, 29.93 and 29.72 or 0.13 and 0.17 in. above normals, following closely in rear of low-pressure area No. V, with lower temperatures and clearing weather. 11th, a. m. barometers at North Platte, Dodge City, and Santa Fé, 29.80, 29.82 and 30.03, or 0.21, 0.20 and 0.18 above

normals; minimum temperature on summit of Pike's Peak, 29°. 12th, a. m. barometers at Dodge City and Santa Fé, 29.77 and 30.02 or 0.15 and 0.17 above normal; minimum temperature at Santa Fé, 52°. 13th, a. m. barometer at Santa Fé, 29.97 or 0.12 above normal.

No. II.—After the passage northeastward of storm area No. IV the pressure continued gradually rising over the Canadian Maritime Provinces, and on the morning of the 14th exceeded the normal at Halifax and Sydney. 15th, the a. m. barometer at Sydney was 30.21 or 0.21 above normal, and the line of 30.00 included the whole Atlantic States; during the day the pressure increased along the coast and over the East Gulf States, with east to south winds and numerous rains and fog; midnight barometers at Halifax and Cape Henry, 30.19 or 0.21 above normal. 17th, the pressure fell over the northeastern section in advance of storm area No. VI, but continued decidedly above normal in the Southern States until the 19th.

No. III.—appeared during the 14th in the extreme Northwest, preceded by brisk to high winds in Dakota and Minnesota. 15th, a. m., barometer at Bismarck 30.20, or 0.21 above normal; the minimum temperature of the month, 44°, occurred at this station, and frost was reported. 16th, a. m., barometers at Pembina, Omaha and Fort Gibson were 30.14, 30.06 and 30.05, or 0.21, 0.13 and 0.10 above normal; the temperature fell below 40° in the Red River of the North valley, and frost was reported at Bismarck in the morning, but during the day the pressure fell in advance of storm-area No. VII.

No. IV.—probably existed over Hudson's Bay territory prior to the 20th, on which day the pressure rose over the Lake region, with northerly winds, and, by night, clear weather. 21st, pressure rose rapidly throughout the St. Lawrence valley. 22nd, a. m., barometer at Father Point 30.14, or 0.20 above normal. During the day the pressure rose decidedly, southward, over New England and the Middle States, with easterly winds, cloudy and threatening weather and light rains, followed at night by generally clear weather. 23rd, a. m., barometers at Father Point and Boston, 30.14 and 30.21, respectively, or 0.20 above normal. Frost occurred on the summit of Mt. Washington, minimum temperature 35°, and at places in Massachusetts. During the day the pressure fell in the St. Lawrence valley, and by night the highest pressure was off the southern coast of New England. 24th, in the early morning light frosts occurred in New York and Connecticut, but during the day the pressure fell along the entire coast in advance of storm-area No. IX.

No. V.—During the 23rd the pressure rose from California to Minnesota, and thence northwestward in rear of low pressure-areas Nos. XI and IX. Light rains and thunder-showers prevailed during the day from Wyoming to Minnesota, with northerly winds and falling temperatures; southerly winds and high temperatures prevailed along the eastern slope of the Rocky Mountains from Nebraska to northern Texas, the thermometer reaching 100° at Kit Carson, Col., and North Platte, Neb. 24th, the pressure increased rapidly over the Northwest, and at 11 p. m. (Washington time) the highest barometric reading for the month was recorded at Bismarck, namely, 30.32, or 0.35 above normal. Cooler northerly winds gradually extended south and eastward during the day—the temperature fell at North Platte 42° in 24 hours, and at Dodge City 45° (the maximum range of temperature during the month) from afternoon of the 24th to morning of the 25th. During these days heavy rains fell in New Mexico and Colorado as follows: on the 23rd at Silver City, N. M., 3:45 to 5:30 p. m., 2.00 inches, and at Santa Fe, 5:50 to 7:10 p. m., 1.02; on the 24th, about 2 p. m., it commenced raining in Colorado, and about 5 p. m. very heavy rains fell in southern part of State, resulting in most destructive floods along the courses of the Greenhorn, Cucharas, Huerfano, Apache, and all creeks draining the Greenhorn range of mountains; "horses and crops were washed away, and about fifteen miles of the Denver and Rio Grande railroad almost totally destroyed." At Trinidad 1.83 inches of rain fell from 3:30 to 6 p. m. In Iowa the variation of temperature was very great, as is shown by the following records: at Cresco, in the northern part of the State, the a. m. minimum temperature was 50°, and frost was recorded; at Afton, in southern part of State, 2:35 p. m., thermometer exposed to the sun, registered 123°; in Grundy county, in the centre of the State, a severe tornado was reported, accompanied by hail four and a third inches in circumference. Light rains and winds, with a temperature ranging from 40° to 50°, prevailed on the summit of Pike's Peak. 25th, the pressure fell from the Rocky Mountain stations to the Upper Lake region, and rose, with clearing weather and brisk to high northerly to westerly winds, in rear of low area No. IX, in the Ohio valley, Lower Lake region and the St. Lawrence valley. 26th, the highest pressure moved southeastward during the early part of the day from Michigan to the Middle Atlantic coast, and frost was reported at Grand Haven, Detroit and on the summit of Mt. Washington, at which places the minimum temperatures were, respectively, 46°, 51° and 30°. Although the pressure attending this area, after it left the Northwest, was generally below the normal, the decrease in temperature was well marked, the minimum temperatures of the month occurring at nearly all stations from eastern Missouri and southern Michigan to the Middle States and New England.

No. VI.—During the 25th the pressure was highest on the coast of Oregon; a. m. barometer at Portland, 30.17 or 0.16 above normal. 26th, the pressure rose in Idaho, Utah, Montana and Wyoming, and during the 27th much more rapidly from Montana to Minnesota, Iowa, Kansas and Colorado; heavy rains fell during latter part of day in southern portions of Colorado and Kansas. 28th, a. m. barometer at Bismarck and North Platte, 30.23 and 29.85, or 0.24 and 0.23 above normal; at the latter place the minimum temperature of the month, 54°, occurred; during the day this area moved southward, with clearing, followed by clear weather from Montana to Indian Territory and Michigan. 29th, a. m. barometers at North Platte and Dodge City, respectively, 0.26 and 0.24 above normals; minimum temperature of month, 56°, occurred at Dodge City; during the day the pressure rose northeastwardly, with clear weather over the Lake region,

and on the morning of the 30th the maximum pressure was over Michigan. 30th, the pressure rose south-eastward over the Atlantic States, and during the 31st the highest pressure was off the coast, the barometric line of 30.10, running almost parallel with the coast line.

Areas of Low Barometer.—Fourteen are shown on chart No. III., but of these only four developed into severe storms within the limits of the United States.

No. I—is a continuation of No. XI, partly described in the July review. 1st., it was central north of the Lower Lakes; during the morning a barometric trough extended southwestward to Illinois and Iowa, where severe thunder-storms occurred as the winds changed from southerly to northwest in advance of high pressure No. I; as the depression moved eastward, violent thunder-storms, accompanied by high winds and heavy rains continued to prevail in the southwest quadrant, namely, in Illinois, Indiana, Ohio, Pennsylvania and Maryland, in which states much damage was done to buildings and crops; in Saginaw Co., Mich., a terrific hail-storm. 2nd., was central in the St. Lawrence valley, and the area of severe thunder-storms passed over the Atlantic coast; at 4:45 a. m., lat., $38^{\circ} 32' N.$, lon., $70^{\circ} 24' W.$, Brig Kaluna struck by lightning; at Albany, N. Y. 11:45 a. m., most violent rain and hail-storm, lasting 20 minutes, accompanied by heavy hail, course of storm from west to east, rain-fall 1.25 in.; houses struck by lightning and burned, roofs blown off, basements and streets flooded; In the vicinity of Plymouth, N. C., p. m., terrific tornado with extraordinary fall of hail; buildings, fences and largest trees prostrated, live stock killed; great damage to growing crops; Baptist church at Plymouth blown down; at Cape Lookout a NW. wind of 60 miles per hour was recorded; at Holly Springs, Mass., heavy thunder-storm, two men killed by lightning; at Manchester, N. H., terrific thunder-storm with hail, streets flooded. 3rd., probably remained central over northern Maine, with slight rise in pressure and clearing weather.

No. II—appeared in the Northwest during the evening of the 2nd; a small depression also existed in eastern Kansas, where severe thunder-storms were reported. 3rd, it moved south and eastward, and was followed in central Minnesota by a heavy rain and hail-storm, doing much damage to crops. 4th, it moved eastward, and thunder-storms were general from Iowa, in the early morning, to New England during latter part of day; at Anna, Ill., severe wind and hail-storm, three persons killed by falling trees; St. Louis, severe wind-storm, maximum velocity, NW. 72 miles; at Toronto, Can., 3 to 6 p. m., severe storm, commenced with terrific fall of hail in centre of city, stones 5 inches in circumference, weighing over one ounce, lasting 15 to 20 minutes; lightning struck and badly damaged two churches, cellars flooded, sewers bursted; in Saratoga Co., N. Y., about 5 p. m., severe thunder-storm, lasting 20 minutes, with heavy hail; at Philadelphia, 1:15 p. m., thunder-storm, two persons killed; at Morristown N. J., p. m., severe hail and wind-storm, doing much damage; southwest of town, fifty corn-fields cut to the ground. In Connecticut the storm was very severe, a heavy hail-storm passing over Litchfield, Hartford and Tolland Counties; at Colebrook, 11 a. m. to 5 p. m., severe rain and hail-storm, rain-fall, 6.67 inches; at Windsor cattle were killed by lightning, hail-storm two miles wide; in this neighborhood the hail was very heavy, doing great damage to the tobacco crop in Farmington, Ellington and Vernon townships.

No. III—appeared in Manitoba on the afternoon of the 4th and moved southeastward, with thunder-storms in Minnesota. 5th, it advanced eastward to Michigan, and cloudy or threatening weather, with numerous thunder-showers prevailed, thence to the Atlantic coast; the heaviest rain fell from Pennsylvania to North Carolina; at Washington, D. C., 2:45 to 5 p. m., severe thunder-storm, with heavy wind, rain and hail; houses unroofed, and unfinished buildings badly damaged, cellars flooded, sewers bursted, and one life lost by drowning, maximum velocity of wind, N. 53 miles; $40^{\circ} 01' N.$, $64^{\circ} 36' W.$, wind southwest, heavy rain squalls; at Phoenixville, Pa., at night, terrific thunder-storm, two persons killed; Canton, Pa., at night, heavy rain, destructive floods, barns and bridges carried away. 6th, it moved eastward, the pressure being lowest, during afternoon, in Pennsylvania and New York; severe thunder-storms and heavy rains in Maryland, New Jersey, New York and Massachusetts, with much destruction of property; at Providence, R. I., 4 p. m., severe thunder-storm, with very heavy rain, different reports say two inches fell in thirty minutes and nearly four inches in one hour, streets were badly flooded and much damage done; on Mt. Washington, the wind continued from the S. all day, maximum velocity, 66 miles. 7th, centre passed eastward over Maine and New Brunswick, and severe squalls were experienced along the New England coast; at Portland, Me., 3 p. m., wind W. 30 miles, two sail-boats capsized and several driven ashore; Newburyport, Mass., violent thunder-storm and high wind, steamer blown one mile down river; in Narragansett Bay, schooners were driven ashore in Dutch Island Harbor, during a terrific E. wind, and at Newport, during a NW. squall; on Mt. Washington the wind changed, during the preceding night, to NW. and increased to 60 miles per hour.

No. IV—was probably north of Montana during the night of the 5th; 11 p. m., barometer at Virginia City, 29.68 or 0.10 below normal, rainfall 4 to 6:30 p. m., 0.97 inch; light rains, with south to west winds prevailed in Washington Territory and Oregon; at Umatilla, Oregon, the wind reached a velocity of 36 miles from the west. 6th, the pressure fell rapidly in Manitoba; 11 p. m. barometer at Pembina, 29.70 or 0.15 below normal; during the night, a thunder-storm passed southward up the Red River of the North valley. 7th, centre passed eastward north of Lake Superior; brisk to high winds prevailed in Minnesota, Breckenridge, N., and St. Paul, SW., 36 miles. 8th, pressure continued lowest north of the lakes, and falling in the St. Lawrence valley; during the day, the maximum temperatures of the month occurred at most lake stations, and four cases of sunstroke were reported at Cincinnati; during latter part of day and during

the night, severe thunder-storms, with high winds, occurred in Upper Michigan and Massachusetts, and with hail in Ontario and West Virginia; at Norwood, Ont., terrific wind, rain and hail-storm, unroofing and levelling houses, and doing great damage to crops; at Belleville, Ont., severe thunder and hail-storm, doing great damage to crops; in Wetzel Co., W. Va., very destructive wind and hail-storm, track two miles wide, corn and fruit crops destroyed, houses unroofed and cattle killed; high winds at St. Louis, 32; Indianapolis, NW., 34; Louisville, 8:30 p. m., NE., 36; Columbus, 9:23 p. m., NW., 36; Mt. Washington, NW, 58. 9th, centre of depression moved eastward over Maine and New Brunswick to the Gulf of St. Lawrence, minimum pressure, during afternoon, about 29.40 or 0.55 below normal and the isobar of 29.60 including northern New York and the New England States; during the whole day a series of very severe thunder-storms, with high winds and heavy rains prevailed over this region and about 6 p. m., a very destructive tornado passed over Wallingford, Conn. The maximum temperatures of the month occurred at most stations from Maryland to New Haven, Conn., and Springfield, Mass., and ranged from 93° at Washington, D. C., to 84° at Springfield; over this region and along the southern coast of New England fresh to brisk southwest winds continued until after the 4:35 p. m., observation, but north of this area the direction was more southerly and occasionally east and northeast; the barometric gradient was greatest over Connecticut and eastern Massachusetts, and especially so from noon to 4:35 p. m. The following are condensed newspaper extracts and reports of voluntary and Signal Service observers: *Canada*.—Dispatches from various parts of Ontario reported a severe thunder-storm, accompanied by heavy winds and hail, doing great damage; at Belleville houses and barns were greatly injured. *New York*.—At Cape Vincent, thunder-storm during night, (8th-9th,) doing great damage, several buildings struck by lightning—storm on the St. Lawrence terrific; at Dexter, barns struck by lightning; Watertown, most terrific thunder and rain storm from the west, the rain-fall varying from four to five inches in different localities, houses and streets flooded, buildings struck by lightning; at Brownville, streets flooded and barn fired—"thousands of people visited Brownville, August 11th, to view devastation by Friday's storm;" one mile south of Florida, Montgomery county, afternoon, terrific wind and rain storm, with track about one hundred feet wide, unroofing buildings and uprooting trees, &c. *Vermont*.—Burlington, thunder-storms from 4 to 11 a. m., and from 5 to 6 p. m.; South Royalton and Derby Line, thunder-storm, barns struck and burned; Newbury, 6 a. m. to noon, very heavy rain, with lightning; Woodstock, West Charlotte, Lunenburg and Newport, thunder-storms. *New Hampshire*.—On the summit of Mt. Washington, thunder-storms from 6:50 to 8 a. m., and 9:15 to 9:40 p. m., maximum velocity of wind, NW. 52 at 7 a. m.; summit house struck by lightning at 7:15 a. m.; in Cheshire, Merrimac, Hillsboro and Rockingham Counties—at Keene, severe thunder-shower during afternoon, houses struck; Andover Centre, 8 a. m., heavy thunder-storm, house struck; Contoocookville, heavy thunder-storms continuing throughout day, heavy rains; Milford, noon, terrific thunder and hail-storm, much damage to roads and crops; Mt. Vernon, barn struck and burned; Nashua, afternoon, severe thunder-storm with heavy rain, several buildings struck, railroads badly washed; Manchester, afternoon, several places struck by lightning; Auburn, thunder-storm, with hail; Exeter, terrific thunder-storm, with hail, barn struck; Stratham, barns struck and burned; Off Boon Island, near Portsmouth, terrific thunder-storm, at noon, schooner struck and sunk, four cattle struck. *Massachusetts*.—Adams, Berks Co., 4 to 5 p. m., barn struck by lightning and burned; Northfield, Franklin Co., a. m. barn and house struck and burned; West Farms, Hampden Co., tobacco crop damaged, trees, fences and roof blown away; Springfield, 12:25 to 1:05 p. m., heavy thunder-storm; Spencer, Worcester County, afternoon, house struck by lightning; Fitchburg, two heavy thunder-storms during afternoon, houses &c., struck by lightning, streets flooded; Lowell, Middlesex Co., three severe thunder-storms during afternoon, the first most violent, accompanied by hail, houses struck, railroads washed, total rain-fall in 24 hours exceeded four inches, streets and cellars flooded; Waltham, thunder-storm, with hail, windows and sky-lights broken; Woburn, severe thunder-storm, 3 p. m., man struck by lightning and killed, several buildings damaged,—at 5:30 p. m., heavy fall of hail, some stones two inches in diameter; Melrose, severe thunder-showers at 3, 5 and 7 p. m., accompanied by very heavy hail, houses struck by lightning; Malden, 6 p. m., house struck by lightning and burned, one person killed; Somerville, evening, severe thunder-storm, with hail size of walnuts; Chelsea, evening, very furious thunder-storm, considerable washouts; Peabody, heavy thunder-storm, house struck, tanneries flooded; Boston, 5.40 to 8 p. m., severe thunder-storm, with strong NW. wind, rainfall, 3.27 inches, light hail; Cambridge, during the afternoon large hail fell, some stones being two to three inches in length and one inch in diameter, one weighed four ounces, much damage to glass, &c.; Revere Beach, severe thunder-storm, accompanied by heavy hail, some stones measuring over an inch in diameter; In Essex Co., Salem, 9.30 a. m. to 3.30 p. m., severe thunder-storm, house and tree struck by lightning, during evening a second storm; Magnolia, 12.40 to 4 p. m., severe wind and thunder-storm; rain-fall, 6.8 inches; Wenham Lake, day's rain-fall, 7.84 inches, 6.5 in. in three hours, surface of Lake raised 12 inches in thirty hours; Beverly, thunder-storm, house struck; Danvers, afternoon, thunder-storm, houses struck; Lynn, two severe thunder-storms from 1 to 3 p. m., and from 6 to 8 p. m., both accompanied by heavy hail, some stones measuring one inch in diameter, streets and cellars flooded, houses struck by lightning during last shower. Nahant, from noon to 8 p. m., tremendous thunder-storms, accompanied by violent winds, trees uprooted and roads badly washed—at 5:50 p. m., house near Bass Point struck by lightning. Swampscott, 6 a. m., unusually large solar halo, with two sundogs, N. and S.—10 a. m. to 1 p. m., incessant thunder and lightning, with torrents of rain, often two or three storms in different directions at same time, the wind changing several times. Marblehead, during afternoon, unusually severe thunder-storm, three houses struck. At Chebacco Lake, Hamilton, about 1 p. m., most terrific thunder-bolt, house badly damaged,

persons injured. Gloucester, afternoon, heavy thunder-storm, lasting three hours, schooner struck by lightning. Haverhill, very heavy thunder-storm, with hail, doing much damage—the pumping station of the Silver Hill Aqueduct Co. was blown down, trees and fences demolished. Lawrence, from noon to 7 p. m., severe thunder-storms, houses struck, rain in torrents, flooding streets, &c. North Andover, house struck by lightning. Newburyport, violent thunder-storms, with heavy wind, rain and hail all afternoon. Newbury, two men struck by lightning. *Connecticut*.—Colebrook, 3:40 to 4:30 p. m., thunder-storm. Meridan, between 5 and 7 p. m., severe thunder-storm, with heavy wind and rain, building struck by lightning, trees blown down. Southington, thunder-showers from 11 a. m. to night, heavy rain from 5:45 to 6:30 p. m., rain-fall 1.20 inch. New Haven, evening, heavy thunder-cloud to north, with continual discharge of electricity. New London, 7 a. m., large well-defined solar halo; 6:55 to 8:39 p. m., brisk southwest thunder-storm, large hail fell in vicinity, rain-fall 1.98 inch; steamer "Ella" reports severe thunder-storm off Block Island and Watch Hill, R. I., sea exceedingly rough. In regard to the Wallingford tornado, a special report from Sergeant Reed of the Signal Service, numerous newspaper extracts, and an excellent paper by Professor W. H. BREWER, of New Haven, have been studied with the following results: It appears that during the afternoon heavy clouds began to collect in the hills to the northnorthwest and southwest; about 5 p. m. or later a heavy thunder-storm was noticed in the northwest moving towards the village—at first slowly but afterwards more rapidly; a second is said to have come from the southwest and to have met the one from the northwest over a dam situated on the Quinnipiac river, to the west of the village; it was here that the tornado commenced between 6 and 6:30 p. m., having the appearance of a water-spout; it then moved eastward up the east bank, a steep precipice about 35 feet in height, uprooting some of the trees and leaving them lying towards the E.; on the summit of the bank the track of destruction was about 400 feet wide; it then moved S. 70° E. over the sandy plain about 175 rods, and it was in this part of the track that the greatest destruction occurred; its path gradually widened to 600 feet as it traversed the first 40 rods, and to 750 feet about 100 rods from the dam; it here totally destroyed a wooden church and prostrated several of the marble head-stones in the cemetery; all the large monuments were thrown down and appeared to have been lifted up first; two were laid to the east and the rest to the northeast; the debris of the church was also carried north and easterly; a row of wooden buildings with brick foundations was next destroyed, and it was here that all the destruction of life occurred; the tornado then ascended a gentle elevation, about 123 feet above the surface of the plain, at the foot of which an immense amount of debris was deposited, with pieces lying in the direction of the track; trees here appeared to have been pulled up rather than overturned. Near the northern edge of the track, on the plain, houses or debris were carried towards the SSE.; the only house left standing, however, was moved slightly towards the NNE., and appeared to have been literally bombarded with flying missiles and mud; a house at the foot of the incline was also moved slightly NNE., roof carried W. and sides thrown outward. On the summit of the incline (about 210 or 215 rods from the origin) the track was from 1,150 to 1,200 feet wide: here the houses were more substantially built, and less destruction occurred. From this position the track appeared to widen, and the destruction was confined mostly to vegetation. The tornado was preceded during the day by a southwest wind, and immediately by a lull and light fall of rain, during which period great commotion was noticed in the clouds; it was accompanied by a blinding dust and followed by heavy rain; in its course over the plains it was conical in shape, and whirled to the left, the greatest destruction apparently occurring near the northern margin of the whirl. Thirty-one persons were killed and forty or fifty wounded. Several buildings are reported to have been blown down in southern portions of Durham and Killingworth, to the southeast of Wallingford. 10th, centre moved northeastward over the Gulf of St. Lawrence; northwest to southwest winds, cloud and rain continued southwestward to North Carolina, the Ohio valley and Lower Lake region; from 2 to 4 p. m. a severe wind, rain and hail-storm passed over the District of Columbia, and a terrific tornado was reported in Anne Arundel Co., Md.; 45° 33' N., 55° 21' W., fresh SW. and W. gales, heavy sea; Mt. Washington, NW., 60 miles; St. Pierre, Miquelon, severe thunder-storm, schooner struck by lightning. 11th, clearing weather gradually extended southeastward in advance of high pressure No. I, but occasional high winds and rains continued along the coast; off Cape Ann, Mass., severe squall; 42° 10' N., 61° 57' W., W'y storm, high W'y sea. 12th, heavy rains fell, during the morning, on the North Carolina coast, and the observer at Capeville, Va., reports, 9 a. m., three water-spouts on Chesapeake Bay, moving south.

No. V—appeared in Colorado during the 8th.; high temperature prevailed over this section; Fort Fetterman, 103°, max. temp. of month; Denver, 105°, ditto; North Platte, 101°; (103° on the 7th, ditto); Dodge City, 101°, ditto; Omaha, 97°, ditto, four cases of sunstroke, one fatal; at Fort Rice, Dak. T., 4:10 to 4:20 p. m., most terrific hurricane, accompanied by rain and hail, storm-cloud from SW. to E., buildings unroofed and garden crops destroyed, rainfall 1.20 in. in 25 minutes, temperature fell from 99° at 3 p. m. to 65° shortly before storm commenced; at 4:35 p. m., thunder-storm, at Yankton, and at 11 p. m. at Omaha with wind NW., 35 miles. 9th, moved southward over Kansas, in front of high area No. I., severe storms occurred with the change of the wind; at Hannibal, Mo., 5 p. m., terrific wind and heavy rain; St. Joseph, evening, tremendous wind and heavy rain, temperature fell 20° in ten minutes; Dodge City, max. temp. of month, 101°; St. Louis, 8:30 p. m., severe thunder-storm from NW. 10th, moved south to northern Texas, followed by cold northerly winds and heavy rains, during the night and early morning from Missouri to southern Colorado, and during the day, from Indian Territory to New Mexico. 11th, continued southwestward over central Texas, with occasional heavy rains to the coast; at Mason, 1.90 in. rain in 3 hours; Ft. Sill, NW., 36 miles.

No VI—appeared in Manitoba during latter part of the 12th, accompanied by a severe thunder-storm

north of Pembina, the electricity being sufficiently intense at that station to interfere seriously with telegraphic communication. 13th, central north of Lake Superior, with thunder-storms in the Upper Mississippi valley and Upper Lake region, and followed by brisk to high northerly winds in Minnesota and Dakota; Milwaukee, NW. 42 miles; during this day a severe hail-storm occurred in southeastern Wyoming, passing over Fort Laramie and Cheyenne; Cheyenne, 3:35 p. m., terrific hail-storm from NW. to SE, travelling at about 32 miles per hour, demolishing all windows to the north, stones size of hens' eggs, some weighing half a pound—hail fell for ten minutes and was followed by heavy rain. 14th, continued central north of the Lake region, with partly cloudy weather and occasional rains from Dakota to Kansas and thence to the St. Lawrence valley. 15th, centre remained north of the Lakes; light rains and thunder-showers from Missouri to Wisconsin, and thence over the Lake region to the Middle States and southern New England; heavy thunder-showers at Sault St. Marie, and occasional high westerly winds; Milwaukee, — 36; Alpena, SW. 30; Sandusky, NW. 38 miles. 16th, central north of Lower Lakes; severe wind and rain storms from Ohio to Virginia: at Columbus, Ohio, 1 p. m., wind W. 42 miles; Fremont and Dayton, Ohio, terrible wind and hail storms; Swissdale, Alleghany county, Pa., afternoon, violent wind-storm, path very narrow, buildings blown down; at Hazlewood considerable hail fell. 17th, moved eastward to the St. Lawrence valley, with severe thunder-storms in Pennsylvania, New York and along southern coast of New England; Champlain, N. Y., afternoon, fearful wind, rain and hail storm, streets flooded. 18th, centre moved southeast to Maine, with decreasing pressure; 11 p. m., barometer at Eastport, 29.69 or 0.31 below normal, calm; light rains from New England northeastward. 19th, the pressure fell along the entire Atlantic coast, and rapidly in New Brunswick, Nova Scotia and Cape Breton; 7:35 a. m., barometers at Eastport and Halifax, 29.57 and 29.53 or 0.44 and 0.45 below normal; 4:35 p. m., barometers at Halifax and Sydney, 29.27 and 29.18 or 0.68 and 0.80 below; and 11 p. m., 29.20 and 28.44 or 0.78 and 1.56 below, respectively; 3.29 inches of rain fell at Sydney, the wind backing from E. to NE. and SW.—The following notes of the day's weather will show the severity of the storm outside the limits of our stations:—41° 10' N. 66° 13' W., strong NW. wind, heavy rain; 41° 27' N. 65° 46' W., SSW., squally; 41° 45' N. 61° 22' W., W. by N. moderate gale; 42° N. 60° W., violent gale from NW; near Sable Island, hurricane from SE. to SW., lasting 5 hours; 42° 40' N., 59° W., hurricane from ESE., lasting 5 hours and settling into NW. gale, lasting 48 hours, high seas making clean breach over ship; 40° 32' N., 57° 30' W.; a. m., rainy weather, wind SE. increasing, — noon, hurricane lasting 3 hours, wind veering round to SW.—1 p. m., tempest at its height, barometer 29.075, steamer with head to south against a tremendous sea—4 p. m., wind W. blowing gale until noon of 20th; 42° 45' N., 57° W., hurricane from SSE. to SW., lasting 3 hours; 42° 35' N., 56° 30' W., heavy gale commencing at SSE. and blowing hurricane for one hour; 37° 51' N., 59° 52' W.; bark Arvid lost masts in squall and was abandoned next day; furious gale off Cape Breton; Magdalen Islands, violent storm commenced during morning of 19th and lasted to 23rd, wind SE., veering to NE., with great fury, at Etang du Nord a number of boats were damaged or destroyed, and crops suffered severely. 20th, westerly to northerly winds and light rains prevailed from New England, northeastward, with rising pressure.

No. VII.—This area probably had its origin in the Pacific coast States from the 11th to the 15th. During these days the following maximum temperatures of the month occurred: 11th, Winnemucca, Nev., 100°; 12th, Visalia, Sacramento and Red Bluff, Cal., 106°, 100° and 110°.5, respectively; 13th, Red Bluff, 110°.5. 13th, light rains fell during the morning along the coast of California. 14th and 15th, light rains northeastward to Idaho, and during the evening very heavy rains on the mountains in central Nevada; in the towns of Austin and Eureka, situated in canyons, considerable destruction of property by flooding occurred. 16th, rains extended northeastward to Montana and continued in Idaho, Nevada and Utah; at St. George, Utah, 3 to 4:30 a. m., heavy thunder-storm; at Austin, Nev., 11 to 11:30 a. m., "cloud burst." 17th, rain commenced in the Northwest, and the lowest pressure moved to northern Nebraska. 18th to 20th, probably central in Iowa, accompanied by numerous rains and thunder-showers eastward to Illinois and the Ohio valley; afternoon of 19th a very severe thunder-storm, with heavy rains, occurred in eastern Iowa.

No. VIII.—From the 13th to the 17th a low pressure area probably traversed the Gulf of Mexico about in the track indicated on chart. 13th, heavy squalls at Santiago de Cuba. 14th, thunder-storm with southeast winds at Havana. 15th, Punta Rassa, Fla., wind SE. 26 miles, two cattle schooners left, but were compelled to put back, and reported very severe storm in the Gulf. 17th, northeasterly winds and rain along West Gulf coast. Indianola, Tex., 4:35 p. m., E. 29 miles, easterly gales continued throughout the 18th, causing the waters in the bay to be driven in, overflowing streets in several places. Cautionary Signals were ordered at Indianola and Galveston, and were justified as above.

No. IX.—appeared in the extreme Northwest on the 20th, and during the 21st and 22d remained in that section. 23d moved eastward to Wisconsin, with light rain in Upper Lake region. 24th, moved northeastward into Canada, with increasing energy; rains and thunder-showers prevailed from Central Mississippi Valley to the St. Lawrence and New England; Cautionary Signals were ordered on the Lower Lakes and coasts of New England and New Jersey, and were justified on Lake Erie and along the coast from Boston to Portland. 25th, continued central over the mouth of the St. Lawrence; Cautionary Signals were ordered from Baltimore to Smithville, and were generally justified.

No. X.—probably originated in the Ohio Valley during the afternoon of the 20th, where heavy rains fell in advance of high area No. IV; 21st was over the South Atlantic States, and on the 22d probably over the Eastern Gulf.

No. XI.—Existed in northern California on the 21st, and moved northward during the 22d; it was accompanied by light rain in this section.

No. XII appeared in Dakota on the 26th; at Fargo a tornado occurred, accompanied by heavy rain and large hail from NW. to SE, width one mile, length 30 miles; barometer fell $\frac{1}{4}$ inch in ten minutes preceding passage; seven houses blown down, five horses killed and north window panes broken, railroad cars heavily loaded, overturned. 27th, moved southeastward to Wisconsin, accompanied by light thunder-showers; 28th, thence to the Ohio valley, and during the 29th and 30th, southward to the Gulf of Mexico, accompanied by generally rainy weather.

Nos. XIII and XIV probably existed in Manitoba on the 30th and 31st, respectively.

No. XV developed in the Lower Ohio valley on the 30th, and moved northward to Michigan during the 31st, accompanied by generally rainy weather.

INTERNATIONAL METEOROLOGY.

March.—Ship "Garelock" left Calcutta March 1st, passed Cape of Good Hope March 17th; reports March 11th heavy gale from W. and WNW., lasting two days, with terrific squalls; ship hove to 57 hours.

April 3rd.—Bark "Kedar" wrecked in hurricane off Cook's Islands, South Pacific ocean.

May.—The "Argomene," from San Francisco to Liverpool, passed Cape Horn May 11th, and reports, "had southerly gale May 13th, 14th and 15th, with heavy snow squalls."

Bark "Pym" passed Sandy Hook at 3:30 p. m. March 25th, and arrived at Anjer, Java, July 1st reports "March 28th, heavy gales and high seas; May 8th, heavy gales and squalls; 9th, seas carried away cargo, derrick and everything movable on deck; hurricane increasing; bar. 29.40; 19th, 0.15 p. m., lat. $36^{\circ} 18' S.$, lon. $10^{\circ} 40' E.$; 20th, high seas; 22d, heavy squall; June 2d, heavy gale and high seas; 10th, hard gale and squally; 11th, 4.09 a. m., increasing gale, with terrific squalls; wind veered suddenly to NW; barometer 29.40; 29th, hard squalls, terrific thunder and lightning.

July 4th.—U. S. Naval Hospital, Yokohama, during morning, strong SW. gale, with squalls and rain, 12th, off Rio Grande del Norte, Brazil, heavy squall. Ship "Garelock," on July 3rd in latitude $23^{\circ} N.$, longitude $58^{\circ} W.$, thence to Bermuda, July 13th, reports variable winds, squalls and frequent waterspouts during these days. 16th, Port Elizabeth, Cape Colony, South Africa, SE. gale. 21st, during a gale, a dory, containing part of crew of schooner "Rich," was blown away from vessel and picked up July 25th in latitude $47^{\circ} 11' N.$, $50^{\circ} 02' W.$ Bark "Clifton," on July 21st, in latitude $37^{\circ} 52' N.$, longitude $58^{\circ} 46' W.$, reports, July 22nd, "heavy gale from WSW., lasting 36 hours." Bark "Osage" reports "heavy squall to the westward of Cape Race." 23rd, $54^{\circ} 41' N.$, $25^{\circ} 22' W.$, W. and NW. squally. 28th, $49^{\circ} 30' N.$, $15^{\circ} 15' W.$, NW. to SW. moderate gale, squally, high beam sea, ship rolling heavily and shipping water over all; $41^{\circ} 10' N.$, $49^{\circ} W.$, heavy southerly gale. 29th, $48^{\circ} 51' N.$, $22^{\circ} 02' W.$, NNE. moderate gale and cloudy; $49^{\circ} 51' N.$, $18^{\circ} 33' W.$, NW. wind, high sea. 30th, Batabano, Cuba, heavy NE. storm during night; nine vessels lost—six ashore; vessel also ashore at Cayo Buva, near Cardenas. 31st, $47^{\circ} 43' N.$, $31^{\circ} 23' W.$, rain squalls.

August.—~~3rd~~ $49^{\circ} 30' N.$, $34^{\circ} 53' W.$, NW, strong breeze and swell, fog and rain; $50^{\circ} 30' N.$, $33^{\circ} 15' W.$, squally; $43^{\circ} 50' N.$, $54^{\circ} 42' W.$, high sea; $6^{\circ} N.$, $30^{\circ} 30' W.$, heavy squall, "carried away all spars by the deck." 5th, $45^{\circ} 46' N.$, $50^{\circ} 32' W.$, NW. thunder-storm. 6th, off Pernambuco, Brazil, gale. 8th, Point a Pitre, Guadeloupe, 2 a. m., barometer 29.77, high wind, squalls and rain; $35^{\circ} N.$, $54^{\circ} 30' W.$, bad weather, SW. winds, squalls and high seas until afternoon of the 11th; $44^{\circ} 27' N.$, $54^{\circ} 48' W.$, heavy W. sea all day. 9th, $42^{\circ} 22' N.$, $60^{\circ} 49' W.$, heavy SW. sea during latter part of day; $47^{\circ} 56' N.$, $50^{\circ} 14' W.$, stiff SW. gale during afternoon; $49^{\circ} 26' N.$, $21^{\circ} 06' W.$, variable wind, heavy rain. 10th, Point a Pitre, Guadeloupe, during last few days threatening weather, much rain and thunder; $45^{\circ} 33' N.$, $55^{\circ} 21' W.$, fresh gales from SW. and W., heavy sea; $51^{\circ} 22' N.$, $15^{\circ} 47' W.$, NNW. squally. 11th, $50^{\circ} 51' N.$, $24^{\circ} 08' W.$, squally and cloudy. 12th, Calcutta dispatch: "recent heavy rains have caused destructive floods throughout India, doing much damage in Scinde, Patna, &c.," $49^{\circ} 44' N.$, $33^{\circ} 25' W.$, light rain; $46^{\circ} 04' N.$, $46^{\circ} 58' W.$, WNW. squally, high W. sea; $49^{\circ} 01' N.$, $34^{\circ} 03' W.$, WNW. strong breeze, heavy rain; $52^{\circ} 52' N.$, $31^{\circ} 30' W.$, heavy sea. 13th, $51^{\circ} 07' N.$, $36^{\circ} 47' W.$, strong NW. gale, heavy sea; $29^{\circ} 08' N.$, $23^{\circ} 49' W.$, high sea. 14th, $49^{\circ} 11' N.$, $41^{\circ} 48' W.$, strong NNW. gale, heavy sea; $48^{\circ} 01' N.$, $30^{\circ} 31' W.$, W. moderate storm; $49^{\circ} 18' N.$, $29^{\circ} 24' W.$, WNW. fresh gale, cloudy; $49^{\circ} 27' N.$, $29^{\circ} 04' W.$, W. fresh gale, squally, high sea; $50^{\circ} 30' N.$, $29^{\circ} 26' W.$, W. fresh gale, very heavy W. sea; $49^{\circ} 54' N.$, $5^{\circ} 0' W.$, SW. to W. fresh gale, rough sea. 15th, $47^{\circ} 30' N.$, $36^{\circ} 10' W.$, confused sea; $50^{\circ} 02' N.$, $12^{\circ} 32' W.$, WNW. high sea, stormy. 16th, $51^{\circ} 07' N.$, $24^{\circ} 42' W.$, N. squally, rain; $50^{\circ} 10' N.$, $20^{\circ} 44' W.$, heavy westerly swell. 17th, $38^{\circ} N.$, $73^{\circ} W.$, hurricane from SE., backing to NE. and NW., high seas; $50^{\circ} 15' N.$, $32^{\circ} 30' W.$, high sea. 18th, $48^{\circ} 32' N.$, $39^{\circ} 51' W.$, N. moderate gale, high sea; $49^{\circ} 50' N.$, $8^{\circ} 30' W.$, high W. sea swell. 19th, $47^{\circ} 38' N.$, $37^{\circ} 40' W.$, fresh northerly gale; $49^{\circ} 45' N.$, $16^{\circ} 41' W.$, increasing SW. winds. 20th, $42^{\circ} N.$, $62^{\circ} W.$, hard W. gale, of short duration; $44^{\circ} 27' N.$, $54^{\circ} 54' W.$, confused sea; $48^{\circ} 34' N.$, $38^{\circ} 42' W.$, fresh northwesterly gale, squalls and rain; $50^{\circ} 10' N.$, 31° to $34^{\circ} W.$, hurricane veering from S. by W. to N. by E. 51° 46' N., 24° 44' W., W. to S. squally, high W. sea; 49° 12' N., 23° 10' W. stormy, very high sea. 21st, 48° 03' N., 29° 21' W., W. stormy, very high sea. 22nd, 51° 14' N., 15° 50' W., fresh SE. squally; 50° 25' N.,